The Effect of Income Inequality on the Health of Selected US Demographic Groups

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A B S T R A C T

Objectives. This study assessed whether documented effects of income inequality on health are consistent across demographic subgroups of the US population.

Methods. Data from the National Health Interview Survey on White and Black non-Hispanics were used. Logistic regression models were estimated with SUDAAN software. Perceived health was the outcome variable.

Results. The results of the multivariate analysis, in which individual family income and county-level poverty rates were included, were not consistent with existing research. In the presence of covariates, the conditional effects of inequality were restricted to Whites aged 18–44 years in the 2 highest income inequality quartiles and middle-aged Whites in counties with the highest level of income inequality. The health of Blacks of all ages, elderly Whites, and middle-aged Whites outside of the areas of highest inequality was unaffected when controls for individual characteristics and county-level poverty were in place.

Conclusions. For the United States, the independent and direct contribution of income inequality to the determination of self-perceived health net of individual income and county income levels is restricted to certain demographic groups. (*Am J Public Health.* 2000;90: 1892–1897)

Relative income distributions have been shown to affect morbidity and mortality prospects both cross-nationally and nationally at the state, county, and metropolitan statistical area level in the United States.[1–7] Initially, the bulk of this research focused on the health of populations, with the supporting data restricted primarily to ecologic correlations between indicators of income inequality and aggregate morbidity or mortality outcomes. Consequently, criticism has focused on the validity of ecologic inference, the measurement of income, the exclusion of covariates, and the applicability of the aggregate geographic unit.[8–12]

More recent research has remedied the difficulties with ecologic inference by examining income inequality with data on both individuals and aggregates such as tracts, counties, states, and primary sampling units in the United States.[11,13–15] These studies directly attempt to test the mechanisms by which income inequality is linked to individual mortality or morbidity by including both aggregate and individual measures of income. The evidence from these studies is decidedly mixed, however. Although these studies vary substantially in design and implementation, the lack of robust findings suggests that observed ecologic effects of income inequality may not have a simple analog when measured for individuals. One potential source of these discrepancies, beyond the technical difference, is that analysts have largely ignored potential variability in the effect of income inequality on the health of demographic subgroups in the United States in particular.

Conceptually, in previous research, income inequality was hypothesized to affect how communities invest in the health and well-being of individuals and how individuals perceive both their status within the community and their connection to it.[16–20] These studies then linked the differential life circumstances of individuals to living in regions of high income inequality compared with living in areas of low income inequality. The underlying force that influences both the socioeconomic configuration of communities and the relation of individuals to those communities is how income inequality manifests itself spatially. Income inequality generates spatial segregation in residence along both racial/ethnic and economic lines. The community-level consequences of income inequality are the spatial isolation of the wealthy from the poor and the selective abandonment of the neighborhoods of the poor and of racial/ethnic minorities. The selective geographic deterioration of the local environments then may have powerful effects on morbidity and mortality prospects, especially for minorities and poor persons of all races/ethnicities, that are equal to the purely social and psychologic mechanisms linking income inequality to health suggested to date.

The relation between individual social disadvantage and morbidity or mortality has been shown to be highly differentiated across demographic groups in the United States, indicating that past analyses of income inequality and morbidity or mortality also have been further complicated by existing racial/ethnic and age differences in income and mortality prospects. Differential disease prevalence for racial/ethnic subpopulations reflects not only racial/ethnic discrimination but also intricate interactions with socioeconomic opportunities and residential environments. The mechanisms through which socioeconomic characteristics are reflected in health operate at the individual, neighborhood, and community level. Thus, the mechanisms by which inequality influences the health prospects of minorities and persons

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of different ages are likely to be further confounded by structural segregation, including residential and labor force segregation, social discrimination, and institutional racism.

African Americans are likely to be most affected by the geographic manifestations of income inequality, because they are most likely to live in poor and marginal neighborhoods. It is, therefore, important to disentangle the direct effects of income inequality from the consequences of structural segregation. We hypothesized that the indirect effects of income inequality as measured by the economic development of counties would be more pronounced for minority populations. Given the overlap between race/ethnicity and social class in the United States, and the subsequent overlap of economic and residential segregation, the geographic consequences of income inequality may provide critical insight into the inconsistent findings of income inequality across subgroups reported in studies in the United States.

In this article, we report that a portion of the empirical ambiguity that exists in this literature may be a result of the differential pathways from income inequality to health for demographic subpopulations in the United States. Without data at different levels of geographic aggregation, it is difficult to definitively trace these pathways, but this research attempts to disentangle a portion of the differences.

Methods

In this study, individual health and socioeconomic data from the National Health Interview Survey (NHIS) were linked to county-level measures of income inequality constructed from the 1990 census to assess the effect of county-level income inequality on the self-reported health of Whites and Blacks in 3 age groups. Measures of family income at the time of interview and other measures of individual and county characteristics were included. The analysis was stratified by the 6 age and race/ethnicity groups to provide insight into the link between income inequality, racial/ethnic residential segregation, and poverty concentration in the United States.

Data Collection

Data from the NHIS were concatenated for 3 consecutive years, 1989 through 1991. The NHIS is an annual survey conducted by personal interview of a stratified multistage probability sample of US households. Detailed information is gathered on demographic and socioeconomic characteristics, health habits, health care use, and health status from a nationally representative sample of individuals.[21] These data were supplemented with information from the 1990 census Summary Tape Files 3-A (STF3A), which contain economic and demographic information for states and their geographic subdivisions. Individual records from the NHIS were linked to census data with county Federal Information Processing Standards (FIPS) codes, which uniquely identify the county. Six race/ethnicity and age groups were analyzed separately—White and Black non-Hispanics in 3 age groups—(18 to 44 years, 45 to 64 years, and 65 years and older)—to demonstrate that both income inequality and other characteristics of the place of residence have substantially different effects by race/ethnicity and age.

Measures

Morbidity was the focus of this study because as mortality rates level off and chronic diseases become more prominent, morbidity is a more salient measure of the health response to social inequality. In addition, given the mechanisms by which inequality affects health, morbidity is likely to show a faster response to increases in inequality over time. Of all morbidity indicators, perceived health has been shown to be the strongest predictor of mortality.[22] In this analysis, the 5-point scale available in the NHIS was dichotomized into those in fair or poor health and those who rated their health as good, very good, and excellent.

Measures at the individual level included age, sex, a logged family income–to–needs ratio, and continuous years of schooling. For individuals younger than 25 years, the income and education measures were, at best, proxies for their true socioeconomic status, because these individuals may not have yet completed their education and may still live in their parents' households. Nevertheless, persons in this age group were retained in the sample because past research has suggested that premature morbidity may be specifically linked to income inequality. The income-to-needs ratio was calculated based on midpoints of income categories adjusted for family size—an approach that provides for comparability across households of different size. Those persons with missing family income were excluded from the analysis. Additional analyses (not shown) indicated that the exclusion of persons with missing income did not significantly alter the individual or contextual effects of income inequality on health. Persons of Hispanic origin and who identified themselves as other race also were excluded, because the residential patterns of these groups are more difficult to characterize.

Counties provide a useful unit of analysis, because they range from completely rural to metropolitan, a more representative geography than the geographic units used in previous research. States and metropolitan areas are limited in the range and variability of living conditions as well as in the degree of variability in income inequality. Counties are used to ensure a wider range of prosperity, demographic heterogeneity, and social infrastructure, and so nonmetropolitan areas are not neglected. Economic and racial/ethnic heterogeneity *within* counties does cause some ambiguity, because the constituent communities can vary substantially in composition. Nevertheless, counties are the best single comprehensive unit in which to assess income inequality.

Two variables were used at the county level from the 1990 census and attached to the individual records from the NHIS. County poverty levels are measured by the percentage of county households with incomes under the official US poverty threshold for each survey year and range from 2.8% to 44.2% of the county households represented in the NHIS. The inclusion of county-level poverty rates then allows the confounding of the basic economic development of the counties to be controlled and demonstrates the indirect effects of income inequality on residential segregation by income for disadvantaged subgroups.

The second variable constructed from the census data was a measure of income inequality, the Gini index, which has a theoretical range of 0 to 1, with 0 representing complete equality. In a comparison of the measures of inequality associated with mortality, Kawachi and Kennedy[3] found that they were highly correlated in the United States and that the association with mortality was similar regardless of the measure used. In this analysis, the overall range of the Gini index across counties was 0.38 to 0.85. These figures are, in general, higher than those based on all counties in the United States, because the counties contained in the NHIS sample design are more likely to be within large metropolitan areas, which are characterized on average by higher rates of income inequality. Both the Gini index and the percentage of households in poverty are relatively skewed in their distributions; thus, they are measured in empirical quartiles. Blacks are disproportionately found in counties with high income inequality, with nearly half of the Blacks in this sample in counties of the highest level of inequality compared with one quarter of the Whites. The range of these quartiles appears in the notes for Tables 2 and 3. The correlation between the county-level Gini index and the percentage of households in poverty is relatively low (–0.18), as are cross-level correlations.

Analysis Strategy

The data were analyzed with the SUDAAN (Research Triangle Institute, Research

TABLE 1—Sample Characteristics, by Race/Ethnicity and Age: National Health Interview Survey (NHIS), 1989–1991[a]

	White, Non-Hispanic, Aged 18–44 y	Black, Non-Hispanic, Aged 18–44 y	White, Non-Hispanic, Aged 45–64 y	Black, Non-Hispanic, Aged 45–64 y	White, Non-Hispanic, Aged ≥65 y	Black, Non-Hispanic, Aged ≥65 y
Mean age, y	31.3	30.2	53.9	53.8	73.4	73.3
Mean educational attainment, y	13.2	12.5	12.7	11.2	11.3	8.8
Percentage male	49.6	44.7	48.7	45.2	42.7	40.5
Mean family income, $	38 340	25 640	42 364	27 779	24 032	15 492
Median county Gini index	0.424	0.447	0.421	0.456	0.425	0.457
Median percentage of households in poverty in county	11.9	13.7	11.9	13.7	12.2	15.0
Percentage in fair or poor health	4.9	10.8	14.5	28.8	26.5	41.7

[a]Tabulations for the NHIS were weighted.

Triangle Park, NC) logistic regression procedure. This software accounts for the clustered sample design of the NHIS and also for the lack of independence in the error terms when aggregate-level data are used in individual-level models. The county is used to form the primary sampling unit, which is a sampling stratum in the NHIS sample design. The standard specification of the models in SUDAAN is therefore adequate to account for the lack of independence in the error terms,[23,24] although it does not account for the model misspecification associated with cross-level inference in multilevel models of this type. Thus, caution is warranted when drawing conclusions about the modifying effect of income inequality on other individual-level determinants of health such as family income or education.

We first examined the bivariate association between county-level income inequality and health for all 6 race/ethnicity and age groups to assess the degree to which these results confirm other analyses of this type. The next step was to add individual-level variables to the model of income inequality as well as the county measure of percentage of households in poverty and to compare these findings with the bivariate associations and across race/ethnicity and age groups.

Results

Table 1 contains descriptive characteristics of each of the 6 demographic groups examined in this study. The analyses include weights that recalibrate the sample to reflect the complex sample design of the NHIS. Across all age groups, Blacks were likely to be younger, less well educated, and poorer than Whites. They also were more likely to live in counties with higher poverty rates and higher income inequality. More important, a much larger proportion of Blacks than of Whites were in fair or poor health at all ages; the gap between Blacks and Whites increased in middle age so that the proportion of Blacks in poor health was nearly twice that of Whites.

The bivariate, or unadjusted, odds ratios between income inequality and health appear in Table 2. The quartile values were compared to the areas with the lowest inequality. The odds ratios are within the range of, albeit slightly larger than, those estimated by Kennedy et al.[19] for state income inequality and the health of the population in general with data from the Behavioral Risk Factor Survey.

With the exception of the elderly and of young Whites in counties of low to moderate inequality, individuals residing in counties with income inequality above the lowest level had significantly poorer health. Among young and middle-aged Blacks, these effects were quite large. Thus, for Blacks aged 18 to 44 years, the risk of being in fair or poor health was more than 50% greater for persons living in areas with the highest income inequality (areas with a Gini index greater than 0.454). Although in most cases the confidence intervals overlap, it also appears that increasing risk is associated with greater levels of inequality. For instance, among young and middle-aged Whites, the odds ratios increase from approximately 1.16 for areas of low moderate inequality to more than 1.40 for areas of highest inequality compared with counties with the lowest levels of inequality. This suggests that the adverse effects of income inequality on health increase along a gradient, at least for Whites. The lack of an effect for elderly Blacks and the limited effect for elderly Whites are consistent with other research.[15]

Table 3 presents the results for the multivariate models that include family income, other individual covariates, and county poverty rates and income inequality. We present adjusted odds ratios for each of the covariates and specify whether these coefficients are statistically significant at conventional levels. The picture that emerges from these analyses is very different from what appears in Table 2. In the presence of covariates at the individual and county level, the conditional effects of income inequality are restricted to Whites aged 18 to 44 in the 2 highest income-inequality quartiles and middle-aged Whites in counties with the highest level of income inequality. The direct effects of income inequality, after control for individual covariates and county-level poverty rates, do not apply to Blacks of all ages and elderly Whites. The age- and race/ethnicity-specific odds ratios show the net association between income inequality and health in each of the demographic groups.

The direct effects of income inequality for young and middle-aged Whites persist across models. The adjusted odds ratios for young Whites are only partially attenuated in comparison with the bivariate odds presented in Table 2. Young Whites in counties of highest income inequality remain at an almost 50% increased risk for fair or poor health compared with young Whites in counties of lowest inequality. Middle-aged Whites are at about 20% increased risk for poor health in the same counties.

Discussion

Mixed evidence from previous analyses that controlled for individual or family income in estimating the effects of income inequality on morbidity and mortality led us to reexamine the issue in a large, nationally representative sample with externally valid measures of income inequality. Our analysis was conducted for 6 subpopulations, because it is well established that both age and race/ethnicity differentially moderate the relation between family income and health and between place of residence and health. These results suggest that both race/ethnicity and type of morbidity, as proxied by age, may be mediating factors in the relation between inequality and morbidity.

In the current study, the relation between income inequality and morbidity was highly differentiated across demographic groups. The

TABLE 2—Bivariate Odds Ratios for Being in Fair or Poor Health, by Income Inequality, Race/Ethnicity, and Age: National Health Interview Survey, 1989–1991

Race/Ethnicity and Age Gini Coefficient	Sample Size	Fair/Poor Health, %	Bivariate Odds Ratio	95% Confidence Interval
White, non-Hispanic, 18–44 y				
Lowest inequality	21 723	4.2	1.00	
Low moderate inequality	19 889	4.8	1.14	0.99, 1.30
High moderate inequality	18 921	5.5	1.34	1.18, 1.51
Highest inequality	14 487	5.9	1.46	1.26, 1.70
Black, non-Hispanic, 18–44 y				
Lowest inequality	1 283	8.5	1.00	
Low moderate inequality	2 505	11.3	1.38	1.04, 1.84
High moderate inequality	2 854	13.2	1.67	1.28, 2.17
Highest inequality	7 860	11.9	1.53	1.20, 1.96
White, non-Hispanic, 45–64 y				
Lowest inequality	10 873	12.3	1.00	
Low moderate inequality	10 200	14.1	1.16	1.01, 1.32
High moderate inequality	9 872	16.1	1.37	1.19, 1.58
Highest inequality	7 334	16.8	1.41	1.22, 1.62
Black, non-Hispanic, 45–64 y				
Lowest inequality	557	22.4	1.00	
Low moderate inequality	1 090	29.9	1.57	1.11, 2.23
High moderate inequality	1 195	32.6	1.84	1.34, 2.53
Highest inequality	3 541	29.0	1.52	1.13, 2.03
White, non-Hispanic, ≥65 y				
Lowest inequality	6 100	24.7	1.00	
Low moderate inequality	7 032	25.1	1.02	0.89, 1.15
High moderate inequality	7 137	28.3	1.22	1.07, 1.39
Highest inequality	5 278	28.7	1.18	1.04, 1.35
Black, non-Hispanic, ≥65 y				
Lowest inequality	210	37.1	1.00	
Low moderate inequality	219	43.1	1.53	0.96, 2.46
High moderate inequality	719	42.7	1.46	0.96, 2.22
Highest inequality	832	40.7	1.29	0.85, 1.97

Note. The omitted category in each case is the lowest empirical quartile of the Gini coefficient for the entire distribution. All bivariate comparisons are made to the lowest level of inequality. No overlapping confidence intervals indicate additional differences between the remaining quartiles. Gini coefficient ranges for the county inequality levels are as follows: lowest inequality, 0.305–0.405; low moderate inequality, 0.406–0.426; high moderate inequality, 0.427–0.454; and highest inequality, 0.455–0.576.

direct effects of income inequality were observed, exclusive of individual covariates and county-level poverty rates, only for young and middle-aged Whites. The corresponding association was not observed for Blacks of all ages, elderly Whites, and middle-aged Whites outside of the areas of highest inequality. However, the effects of county poverty were most pronounced for these subpopulations.

The conflict in evidence from previous analyses that assessed the effect of both family income and income inequality at the aggregate level or with all individuals is caused, in part, by the presentation of a single summary measure of the income inequality effect for the entire population. It is not difficult to understand how an analysis conducted for the entire population may well be dominated by the results for young and middle-aged Whites, because in this analysis they represent more than 69% of the total sample.

Our analysis further suggests that the mechanisms through which income inequality translates into an individual's morbidity risk are specific to demographic groups. In certain subpopulations, the pathway from income inequality to health appears to be via the direct effects of income inequality, whereas in others it appears to be through the effects of income inequality on the economic geography of demographic groups. The geographic concentration of the poor, generated by high levels of income inequality in the metropolitan area or state, may be the predominant pathway for Blacks.[12,25–30] Thus, some of the departures from past research shown here may result from the different levels at which income inequality is measured. Ambiguity in past analyses also may have been caused by the exclusion of measures of the absolute economic conditions in the areas of interest.

In our analysis, the county-level poverty measure was a much better and more consistent predictor of poor health for Blacks and Whites across most of the age groups. Without measures for absolute economic standing in the county, income inequality as a measure of the effect of the relative distribution of income is confounded. In this analysis, county-level poverty rates accounted for a 15% to more than 60% increase in the risk of being in fair or poor health across the population groups analyzed.

Conclusion

For the United States at least, it is clear that when individual income and county income levels are controlled for, the independent and direct contribution of income inequality to the determination of self-perceived health is restricted to some demographic groups. It is also apparent that different pathways from income inequality to health exist for other groups. These results suggest that caution is warranted when population-level mechanisms are posited to explain the more limited effect of relative income distributions on the health outcomes of individuals. Consequently, future attempts to explore the effects of income inequality on adult morbidity or mortality in the United States must address the influence of demographic and geographic variability.

Based on these findings, we recommend future studies that further clarify the direct and

TABLE 3—Adjusted Odds Ratios for Being in Fair or Poor Health, by Race/Ethnicity and Age: National Health Interview Survey, 1989–1991

	White, Non-Hispanic, Aged 18–44 y	Black, Non-Hispanic, Aged 18–44 y	White, Non-Hispanic, Aged 45–64 y	Black, Non-Hispanic, Aged 45–64 y	White, Non-Hispanic, Aged ≥65 y	Black, Non-Hispanic, Aged ≥65 y
Income inequality						
Lowest inequality	1.00	1.00	1.00	1.00	1.00	1.00
Low moderate inequality	1.10	0.99	1.07	1.01	0.97	1.16
High moderate inequality	1.23**	1.02	1.12	1.14	1.09	0.98
Highest inequality	1.48**	0.93	1.19*	1.01	1.05	0.88
County poverty level						
Lowest poverty	1.00	1.00	1.00	1.00	1.00	1.00
Low moderate poverty	1.05	1.32	1.16**	1.59*	1.13	1.51
High moderate poverty	1.08	1.63**	1.07	1.58*	1.10	2.14**
Highest poverty	1.00	1.45*	1.38**	1.22	1.34**	1.50
Individual characteristics						
Age, y	1.06**	1.07**	1.05**	1.04**	1.01**	0.99
Sex						
Male	1.00	1.00	1.00	1.00	1.00	1.00
Female	1.24**	1.38**	0.92**	1.22**	0.89**	1.04
Income to needs	0.57**	0.65**	0.45**	0.52**	0.59**	0.94**
Education	0.80**	0.85**	0.85**	0.88**	0.91**	0.67**
Sample size	75 020	14 502	38 279	6383	25 547	3481
−2 Log likelihood ratio (χ^2)	2940.72**	938.01**	4482.48**	986.92**	1618.56**	206.33**

Note. The omitted category in each case is the lowest empirical quartile of the Gini coefficient or county-level poverty for the entire distribution. Gini coefficient ranges for the county inequality levels are as follows: lowest inequality, 0.305–0.405; low moderate inequality, 0.406–0.426; high moderate inequality, 0.427–0.454; and highest inequality, 0.455–0.576. The poverty-level ranges were as follows: lowest poverty, 2.82%–8.61%; low moderate poverty, 8.62%–12.15%; high moderate poverty, 12.16%–15.69%; and highest poverty, 15.70%–44.17%.
*Significant at $P \leq .05$; **significant at $P \leq .01$.

indirect pathways from income inequality to health and help guide the policy implications of this research. Population-level policies that redress income inequality will certainly ameliorate many of the social and economic conditions that affect health, but for some demographic subpopulations, the route will be circuitous. □

Contributors

F. B. LeClere and M.-J. Soobader jointly planned the study, conducted the analysis, and wrote the paper.

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